

## **Contamination of Meat Products by Trace Quantities of Nitrosodiethanolamine (NDELA)**

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*During the past years, there has been growing interest in the presence of N-nitroso compounds within the environment and consumer products because of the known carcinogenicity and mutagenicity of many of these compounds (Krull et al. 1979). Although neither the safety intake level of nitrosamines for human beings nor a direct evidence of carcinogenicity of these compounds in man has been properly established, most of the developed countries have adopted regulatory measures to ensure that the amount of these compounds present in foods meant for human consumption is reduced to a minimum.*

*At present there is scanty information on the level of nitrosamine contamination of consumer products in Nigeria (Basir and Maduagwu 1978, Okieimen and Akintola 1985). In a previous communication (Okieimen and Akintola 1985), the level of nitrosamine contamination of some consumer products in Nigeria was reported. The relatively high levels of contamination of these products by N-nitrosamines, particularly of one of the meat products (suya) required that a more detailed investigation be carried out on this meat product.*

*Suya is a popular indigenous ready-to-eat meat product. The most common type of suya is prepared by coating boneless meat (usually beef) with spices (made by mixing pepper, groundnut (peanut) powder, vegetable oil and salt). The spice coated meat is attached to a stick or iron rod and grilled around or on top of an open fire (Igene and Mohammed 1983). In this communication, we report on the levels of N-nitrosodiethanolamine (NDELA) in suya and the effect of storage and of temperature on the level of NDELA contamination of this product.*

### **MATERIALS AND METHODS**

*Samples of suya were obtained from five randomly selected suya retail outlets in Benin City. The suya were not different from those actually on retail.*

The samples were analysed for NDELA using the method developed by Telling and Dunnett (1981). Analysis were carried out on (a) the raw beef meat, (b) pregrilled suya, (c) freshly grilled suya, and (d) grilled suya stored for various periods of time and reheated.

The extraction and analytical procedures were reported in a previous communication (Okieimen and Akintola 1985). Duplicate extractions were made on each sample and the average of the absorbance measurements was used to calculate the level of NDELA contamination of the samples.

## RESULTS AND DISCUSSION

The level of nitrosamine contamination of the raw meat, ungrilled suya and freshly grilled suya are shown in table 1. It would be seen that the raw beef meat from the five locations gave low levels (0.25 mg/kg - 0.36 mg/kg) of NDELA contamination. The pregrilled suya showed higher values (1.28 mg/kg - 1.89 mg/kg) NDELA content. It is thought that the components of the spices used in coating the raw meat may contain NDELA and/or NDELA precursors whose slow reaction at ambient temperature with each other and/or with the meat sample would lead to be observed increased level of NDELA contamination.

Table 1. N-nitrosodiethanolamine (NDELA) content of suya levels of NDELA contamination (mg/kg)

Locations	Raw Meat	Pregrilled Suya	Freshly grilled Suya
A	0.31	1.59	0.91
B	0.25	1.28	0.87
C	0.31	1.86	1.22
D	0.36	1.89	1.20
E	0.26	1.54	1.07

NDELA content of mixed spices = 1.02 mg/kg.

The result (table 2) show that the level of NDELA content of freshly grilled suya varied from 0.87 mg/kg to 1.29 mg/kg; representing between 31% and 43% reduction in the level of NDELA contamination of the grilled products.

The effect of storage on the level of NDELA contamination of suya is shown in table 2. It would be seen that the NDELA content of suya gradually increased for 18 hours to a maximum of 2.02 mg/kg. Suya has been shown to contain a wide range of bacteria flora (Igene 1983, Igene and Abulu 1984), and it is thought that bacterial accentuated nitrosation reaction would lead to high level of nitrosamine in the cold meat product. The

Table 2. Effect of storage<sup>a</sup> and heat treatment on the NDELA content of suya  
level of NDELA contamination (mg/kg)/time of storage (Hrs)

Locations	0.00	6.0		12.0		18.0		24.0	
		cold	reheated	cold	reheated	cold	reheated	cold	reheated
A	0.91	1.24	1.64	1.71	1.75	1.91	2.02	1.90	2.02
B	0.87	0.98	0.99	1.09	1.19	1.20	1.29	1.19	1.29
C	1.22	1.24	1.91	1.82	1.86	1.76	1.89	1.82	1.90
D	1.20	1.24	1.35	1.51	1.55	1.58	1.60	1.59	1.60
E	1.07	1.55	1.80	1.97	1.91	1.71	1.97	1.91	1.97

<sup>a</sup> Samples were stored at ambient temperature wrapped in polyethylene bags. Part of the sample was analysed cold and the other part heated over a bunsen burner for 2 - 3 minutes.

effect of heating the cold meat products for between 3 minutes - 5 minutes is shown in table 2. The results show that the heated meat products gave higher levels of nitrosamine contamination. These results suggest that increase in temperature has an accelerating effect on the nitrosation reaction.

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